



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : E21B 43/24	A1	(11) International Publication Number: WO 00/25002 (43) International Publication Date: 4 May 2000 (04.05.00)
(21) International Application Number: PCT/CA99/00996 (22) International Filing Date: 26 October 1999 (26.10.99) (30) Priority Data: 2,251,157 26 October 1998 (26.10.98) CA (71) Applicant (for all designated States except US): ALBERTA OIL SANDS TECHNOLOGY AND RESEARCH AUTHORITY [CA/CA]; Alberta Research Council, 250 Karl Clark Road, Edmonton, Alberta T6N 1E4 (CA). (72) Inventors; and (75) Inventors/Applicants (for US only): GOOD, William, Keith [CA/CA]; Alberta Research Council, 250 Karl Clark Road, Edmonton, Alberta T6N 1E4 (CA). LUHNING, Rick, W. [CA/CA]; Alberta Research Council, 250 Karl Clark Road, Edmonton, Alberta T6N 1E4 (CA). KISMAN, Kenneth, E. [CA/CA]; 5760 Buckboard Road N.W., Calgary, Alberta K3A 4R6 (CA). (74) Agent: JOHNSON, E., Peter; Ogilvie and Company, 1400 Canadian Western Bank Place, 10303 Jasper Avenue, Edmonton, Alberta T5J 3N6 (CA).		(81) Designated States: IN, RU, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>
(54) Title: PROCESS FOR SEQUENTIALLY APPLYING SAGD TO ADJACENT SECTIONS OF A PETROLEUM RESERVOIR (57) Abstract <p>Steam assisted gravity drainage ("SAGD") is practised in a first section of a reservoir containing heavy oil. When production becomes uneconomic, steam injection into the first section is terminated. Non-condensable gas is then injected into the section to pressurize it and production of residual oil and steam condensate is continued. Concurrently with pressurization, SAGD is practised in an adjacent reservoir section. As a result, some of the residual oil in the first section is recovered and steam loss from the second section to the first section is minimized.</p>		

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1 **PROCESS FOR SEQUENTIALLY APPLYING SAGD TO ADJACENT**
2 **SECTIONS OF A PETROLEUM RESERVOIR**

3
4 **FIELD OF THE INVENTION**

5 This invention relates to recovering heavy oil from an underground
6 reservoir using a staged process involving, in the first stage, steam assisted
7 gravity drainage, and in the second stage, non-condensable gas injection and
8 reservoir pressurization.

9
10 **BACKGROUND OF THE INVENTION**

11 Steam assisted gravity drainage ("SAGD") is a process first proposed
12 by R. M. Butler and later developed and tested at the Underground Test
13 Facility ("UTF") of the Alberta Oil Sands Technology and Research Authority
14 ("AOSTRA"). The SAGD process was originally developed for use in heavy
15 oil or bitumen containing reservoirs, (hereinafter collectively referred to as
16 'heavy oil reservoirs'), such as the Athabasca oil sands. The process, as
17 practised at the UTF, involved:

- 18 • Drilling a pair of horizontal wells close to the base of the reservoir
19 containing the heavy oil. One well was directly above the other in
20 relatively close, co-extensive, spaced apart, parallel relationship.
21 The wells were spaced apart 5 – 7 meters and extended in parallel
22 horizontal relationship through several hundred meters of the oil
23 pay or reservoir;

- 1 • Then establishing fluid communication between the wells so that
2 fluid could move through the span of formation between them. This
3 was done by circulating steam through each of the wells to produce
4 a pair of "hot fingers". The span between the wells warmed by
5 conduction until the contained oil was sufficiently heated so that it
6 could be driven by steam pressure from one well to the other. The
7 viscous oil in the span was replaced with steam and the wells were
8 then ready for production;
- 9 • Then converting to SAGD production. More particularly, the upper
10 well was used to inject steam and the lower well was used to
11 produce a product mixture of heated oil and condensed water. The
12 production well was operated under steam trap control. That is, the
13 production well was throttled to maintain the production temperature
14 below the saturated steam temperature corresponding to the
15 production pressure. Otherwise stated, the fluids being produced at
16 the production interval should be at undersaturated or "subcooled"
17 condition. (Subcool = steam temperature corresponding to the
18 measured producing production pressure – measured temperature.)
19 This was done to ensure a column of liquid over the production well,
20 to minimize "short-circuiting" by injected steam into the production
21 well. The injected steam began to form an upwardly enlarging
22 steam chamber in the reservoir. The chamber extended along the
23 length of the horizontal portions of the well pair. Oil that had
24 originally filled the chamber sand was heated, to mobilize it, and

1 drained, along with condensed water, down to the production well,
2 through which they were removed. The chamber was thus filled
3 with steam and was permeable to liquid flow. Newly injected steam
4 moved through the chamber and supplied heat to its peripheral
5 surface, thereby enlarging the chamber upwardly and outwardly as
6 the oil was mobilized and drained together with the condensed
7 water down to the production well.

8 This process is described in greater detail in Canadian patent 1,304,287
9 (Edmunds, Haston and Cordell).

10 The process was shown to be commercially viable and is now being
11 tested by several oil companies in a significant number of pilot projects.

12 Now, the operation of a single pair of wells practising SAGD has a finite
13 life. When the upwardly enlarging steam chamber reaches the overlying, cold
14 overburden, it can no longer expand upwardly and heat begins to be lost to
15 the overburden. If two well pairs are being operated side by side, their
16 laterally expanding chambers will eventually contact along their side edges
17 and further oil-producing lateral expansion comes to a halt as well. As a
18 result, oil production rate begins to drop off. As a consequence of these two
19 occurrences, the steam/oil ratio ("SOR") begins to rise and continued SAGD
20 operation with the pair eventually becomes uneconomic.

21 If one considers two side-by-side SAGD well pairs which have been
22 produced to "maturity", as just described, it will be found that a ridge of
23 unheated oil is left between the well pairs. It is of course desirable to
24 minimize this loss of unrecovered oil.

1 In Canadian patent 2,015,460 (Kisman), assigned to the present
2 assignee, there is described a technique for limiting the escape of steam into
3 a thief zone. For example, if steam is being injected into a relatively
4 undepleted reservoir section and there is a nearby more depleted reservoir
5 section, forming a low pressure sink, there is a likelihood that pressurized
6 steam will migrate from the undepleted section into the more depleted section
7 – which is an undesired result. One wants to confine the steam to the
8 relatively undepleted section where there is lots of oil to be heated, mobilized
9 and produced. The Kisman patent teaches injecting a non-condensable gas,
10 such as natural gas, into the more depleted section to raise its pressure and
11 equalize it with the pressure in the relatively undepleted section. By this
12 means, the loss of steam from the one section to the other can be curtailed or
13 minimized.

14 The Kisman patent further teaches that pressurizing the more depleted
15 section with natural gas has been characterized by an increase in production
16 rate from that section, if the production well penetrating the section is
17 produced during pressurization.

18 **SUMMARY OF THE INVENTION**

19 In accordance with the present invention, a novel process is provided
20 for producing adjacent sections of an underground reservoir containing heavy
21 oil. Each section is penetrated by one or more wells completed for SAGD
22 operation, preferably one or more pairs of horizontal injection and production
23 wells. The process comprises:

- 1 (a) injecting steam into the first section of the reservoir to practice
2 SAGD and produce contained oil, until the steam/oil ratio rises
3 sufficiently so that further production by SAGD from the section
4 is substantially uneconomic;
- 5 (b) then reducing or terminating steam injection into the first section
6 and injecting non-condensable gas into the section to maintain it
7 pressurized;
- 8 (c) continuing to produce oil from the first section while it is
9 pressurized; and
- 10 (d) concurrently with step (c), injecting steam into the adjacent
11 second section to practice SAGD therein and produce contained
12 oil;
- 13 (e) while preferably maintaining the first section pressurized to
14 substantially the same pressure as exists in the second section
15 during step (d).

16 Steps (b) and (c) constitute a post-steam wind-down of oil production
17 from the first section. Over time, oil production rate will drop off during wind-
18 down and eventually it will again become uneconomic to justify continuing to
19 produce the first section. However it may still be desirable to continue
20 maintaining pressurization in the first section to limit steam loss from the
21 second section.

1 The process provides a strategy for sequentially producing adjacent
2 sections across the reservoir. It takes advantage of gas pressurization to
3 prevent steam leakage from a less depleted section undergoing SAGD to a
4 mature, more depleted section. It also maximizes production from each
5 section by subjecting it to sequential SAGD and pressurization production
6 stages.

7

8 **DESCRIPTION OF THE PREFERRED EMBODIMENT**

9 In accordance with the best mode of the process known to the
10 applicants, it comprises:

11 (a) directionally drilling one or more pairs of wells from ground
12 surface into a reservoir first section, to provide generally parallel,
13 horizontal, co-extensive, spaced apart, upper and lower well
14 portions extending through the section, and completing the wells
15 for SAGD production;

16 (b) establishing fluid communication between the injection and
17 production wells of each pair, for example by circulating steam
18 through both wells, to heat the span between the wells by heat
19 conduction, and then displacing and draining the oil in the span
20 by injecting steam through the upper injection well and opening
21 the lower production well for production;

- 1 (c) practising SAGD in the reservoir first section by injecting steam
2 through the injection wells and producing the produced heated
3 oil and condensed water through the production wells while
4 operating said production wells under steam trap control;
- 5 (d) preparing a second adjoining section of the reservoir for SAGD
6 production by carrying out the provision of wells and establishing
7 fluid communication between the wells of each pair as in steps
8 (a) and (b);
- 9 (e) terminating or reducing steam injection into the reservoir first
10 section injection wells and initiating natural gas injection through
11 said injection wells to increase the pressure in the reservoir first
12 section to about the anticipated steam injection pressure in the
13 reservoir second section and maintaining the pressure at about
14 this level while simultaneously producing residual heated oil and
15 steam condensate through the production wells under steam
16 trap control; and
- 17 (f) concurrently with step (e), practising SAGD in the reservoir
18 second section.

19 In connection with practising steam trap control with wells extending
20 down from ground surface and having riser and horizontal production
21 sections, it is preferred to operate as follows:

- 22 • measuring the downhole temperature at the injection and
23 production wells of an operating pair, using thermocouples;

- 1 • establishing the temperature differential between the two wells and
- 2 throttling the production well to maintain the differential at a
- 3 generally constant value (say 7°);
- 4 • monitoring for significant surges in vapour production rate at the
- 5 ground surface production separator and for surges in steam
- 6 injection rate; and
- 7 • adjusting throttling to minimize the surges.

8 Otherwise stated, a generally constant liquid rate at the wellhead is
9 maintained and the bottomhole production temperature is allowed to vary
10 within a limited range.

11 The invention is characterized by the following advantages:

- 12 • additional oil is recovered from the mature wells during the gas
- 13 pressurization stage, while simultaneously reducing steam leakage
- 14 from the second reservoir section;
- 15 • use is made of the residual heat left in the mature reservoir section;
- 16 and
- 17 • a finite steam-producing plant can be applied in sequence to a
- 18 plurality of adjacent sections of the reservoir, without severe steam
- 19 loss from a section undergoing SAGD to an adjacent depleted
- 20 section.

1 THE EMBODIMENTS OF THE INVENTION IN WHICH AN
2 EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS
3 FOLLOWS:

4 1. A method for recovering heavy oil from an underground reservoir,
5 comprising:

6 (a) injecting steam and producing heated oil and steam condensate
7 by steam assisted gravity drainage ("SAGD") in a first section of the reservoir
8 until it is substantially uneconomic to continue doing so;

9 (b) preparing an adjoining section of the reservoir for SAGD;

10 (c) terminating or reducing steam injection into the reservoir first
11 section;

12 (d) injecting steam and producing heated oil and steam condensate
13 by SAGD in an adjacent second section of the reservoir; and

14 (e) concurrently with step (d), injecting a non-condensable gas into
15 the first section to pressurize it and producing residual oil and steam
16 condensate from said first section.

17

18 2. The method as set forth in claim 1 wherein:

19 the first section is pressurized in step (e) to a pressure about equal with
20 the steam injection pressure in step (d).

INTERNATIONAL SEARCH REPORT

Application No
PCT/CA 99/00996

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 E21B43/24		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC 7 E21B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CA 2 015 460 C (KISMAN KENNETH E) 26 October 1991 (1991-10-26) cited in the application page 4, line 6 - line 18 page 9, line 7 - line 18	1,2
Y	GB 1 463 444 A (SHELL INTERNATIONALE RESEARCH MAATSHAPPIJ) 2 February 1977 (1977-02-02) page 1, line 63 - line 92	1,2
A	US 4 903 768 A (SHU PAUL) 27 February 1990 (1990-02-27) column 2, line 44 - line 61	1
-/-		
<div style="display: flex; justify-content: space-between;"> <input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex. </div>		
* Special categories of cited documents :		
<div style="display: flex;"> <div style="flex: 1;"> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="flex: 1;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>		
Date of the actual completion of the international search <div style="text-align: center; font-weight: bold;">17 January 2000</div>		Date of mailing of the international search report <div style="text-align: center; font-weight: bold;">28/01/2000</div>
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016		Authorized officer <div style="text-align: center; font-weight: bold;">Garrido Garcia, M</div>

INTERNATIONAL SEARCH REPORT

Application No
PCT/CA 99/00996

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 166 504 A (BROWN ALFRED ET AL) 4 September 1979 (1979-09-04) column 1, line 49 - line 65 column 2, line 66 - column 3, line 16	1
A	US 5 318 124 A (ONG TEE S ET AL) 7 June 1994 (1994-06-07)	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

h. International Application No

PCT/CA 99/00996

Patent document cited in search report		Publication dat	Patent family member(s)	Publication dat
CA 2015460	C	14-12-1993	CA 2015460 A	26-10-1991
GB 1463444	A	02-02-1977	CA 1026668 A	21-02-1978
US 4903768	A	27-02-1990	CA 2006967 A,C	03-07-1990
US 4166504	A	04-09-1979	BR 7905405 A	29-04-1980
			CA 1102684 A	09-06-1981
			DE 2930143 A	06-03-1980
US 5318124	A	07-06-1994	CA 2055549 A	15-05-1993
			DE 4238247 A	19-05-1993
			RU 2098613 C	10-12-1997

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 1024.106	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/CA 99/ 00996	International filing date (day/month/year) 26/10/1999	(Earliest) Priority Date (day/month/year) 26/10/1998
Applicant ALBERTA OIL SANDS TECHNOLOGY AND...et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.
☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

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☐ furnished subsequently to this Authority in written form.

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☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

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☐ the text has been established by this Authority to read as follows:

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6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

☒ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/ISA 99/00996

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 E21B43/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 4 903 768 A (SHU PAUL) 27 February 1990 (1990-02-27) column 2, line 44 - line 61 ---	1
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
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"&" document member of the same patent family

Date of the actual completion of the international search

17 January 2000

Date of mailing of the international search report

28/01/2000

Name and mailing address of the ISA

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Fax: (+31-70) 340-3016

Authorized officer

Garrido Garcia, M

INTERNATIONAL SEARCH REPORT

International Application No

PCT/A 99/00996

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 166 504 A (BROWN ALFRED ET AL) 4 September 1979 (1979-09-04) column 1, line 49 - line 65 column 2, line 66 -column 3, line 16 ---	1
A	US 5 318 124 A (ONG TEE S ET AL) 7 June 1994 (1994-06-07) -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PO A 99/00996

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
CA 2015460	C	14-12-1993	CA 2015460 A	26-10-1991
GB 1463444	A	02-02-1977	CA 1026668 A	21-02-1978
US 4903768	A	27-02-1990	CA 2006967 A,C	03-07-1990
US 4166504	A	04-09-1979	BR 7905405 A	29-04-1980
			CA 1102684 A	09-06-1981
			DE 2930143 A	06-03-1980
US 5318124	A	07-06-1994	CA 2055549 A	15-05-1993
			DE 4238247 A	19-05-1993
			RU 2098613 C	10-12-1997

PCT

(PCT Rule 61.2)

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Date of mailing (day/month/year) 20 June 2000 (20.06.00)	in its capacity as elected Office
International application No. PCT/CA99/00996	Applicant's or agent's file reference 1024.106
International filing date (day/month/year) 26 October 1999 (26.10.99)	Priority date (day/month/year) 26 October 1998 (26.10.98)
Applicant GOOD, William, Keith et al	

- ☒ in the demand filed with the International Preliminary Examining Authority on:

24 May 2000 (24.05.00)

- ☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer</p> <p>Manu Berrod</p> <p>Telephone No.: (41-22) 338.83.38</p>
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REC'D 15 NOV 2000

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 1024.106	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/CA99/00996	International filing date (day/month/year) 26/10/1999	Priority date (day/month/year) 26/10/1998
International Patent Classification (IPC) or national classification and IPC E21B43/24		
Applicant ALBERTA OIL SANDS TECHNOLOGY AND...et al.		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 4 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 1 sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input checked="" type="checkbox"/> Certain defects in the international application VIII <input checked="" type="checkbox"/> Certain observations on the international application 		
Date of submission of the demand 24/05/2000	Date of completion of this report 13.11.2000	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Tompouloglou, C Telephone No. +49 89 2399 2077	



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/CA99/00996

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).):*

Description, pages:

1-8 as originally filed

Claims, No.:

1 with telefax of 25/10/2000

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/CA99/00996

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/CA99/00996

POINT V.

The claim is judged as an unambiguous assembly of its feature i.e under the assumption that the word "in" (see Point VIII) has been removed.

The preamble of the claim (text preceding the expression "the improvement comprising") corresponds to CA-A-2015460.

The characterising features of the claim solve the problem of optimising the strategy of sequential exploitation of the two sections of a reservoir because they result in the minimum possible loss of heat of the steam. Indeed that fact that the first section is also producing whilst non-condensable gas is injected in it mean that any possible loss of steam of the second section is exploited to the maximum due to the horizontal arrangement of the production and injection wells.

Although this arrangement is known from US-A-5318124, the step of the concurrent injection of the non condensable gas into the first section of the reservoir is not known from this document.

POINT VII

Following should have been taken into account:

- Rule 5.1 (a) ii) reference also to US'124 and their disclosure in the description.
- Rule 5.1 (a) iii) PCT: description in conformity with the new claims.

POINT VIII

The use of the word "in a method" makes it unclear whether protection is sought for the improvement only or for all the features defined in the claim. Therefore Article 6 is PCT infringed with regard to clarity.

1 **THE EMBODIMENTS OF THE INVENTION IN WHICH AN**
2 **EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS**
3 **FOLLOWS:**

4 1. In a method for recovering heavy oil from an underground reservoir
5 wherein a first section of the reservoir is at least partially depleted and an
6 adjoining second section is less depleted, and wherein injected fluid can move
7 from one section to the other, and wherein a non-condensable gas is injected
8 into the first section while steam is injected into the second section so that the
9 pressure in the two sections of reservoir is about equal, the improvement
10 comprising:

11 the first section has been depleted by practising steam assisted gravity
12 drainage ("SAGD") using one or more horizontal pairs of injection and
13 production wells;

14 practising SAGD in the second section using one or more horizontal
15 pairs of injection and production wells by injecting steam through the injection
16 wells and producing oil and steam condensate through the production wells;

17 and concurrently injecting the non-condensable gas through the
18 injection wells of the first section and producing oil through the production
19 wells of the first section while maintaining the pressure in the two sections of
20 reservoir about equal.